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(54) **HEATING DEVICE FOR COMPLEXLY FORMED SURFACES**

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CPC ***H05B 3/345*** (2013.01); ***H05B 3/347*** (2013.01); *H05B 2203/004* (2013.01); *H05B 2203/007* (2013.01); *H05B 2203/015* (2013.01); *H05B 2203/029* (2013.01); *Y10T 29/49117* (2015.01)

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USPC 219/202, 204, 209, 528, 529, 494, 542, 219/546, 549

See application file for complete search history.

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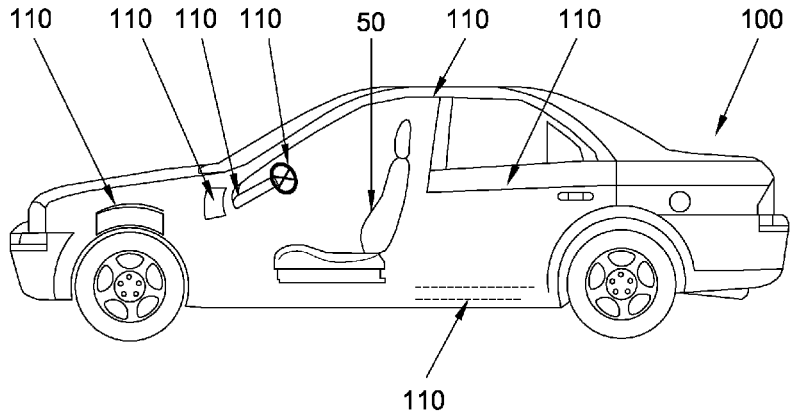
(57) **ABSTRACT**

The present invention relates to an electrical temperature control for controlling the temperature of surfaces. It is envisaged that the temperature control has at least one heat distribution device which covers at least parts of the surface to be temperature controlled.

17 Claims, 3 Drawing Sheets



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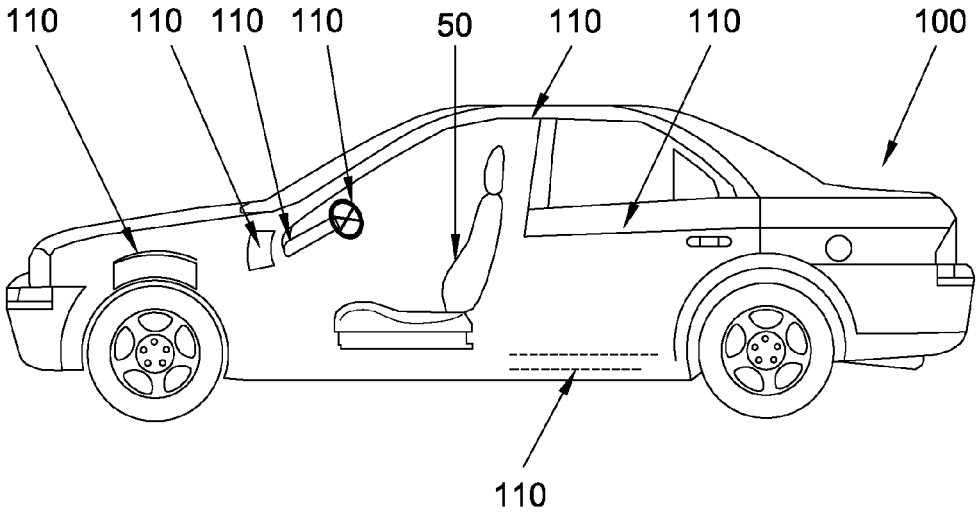

Fig. 1

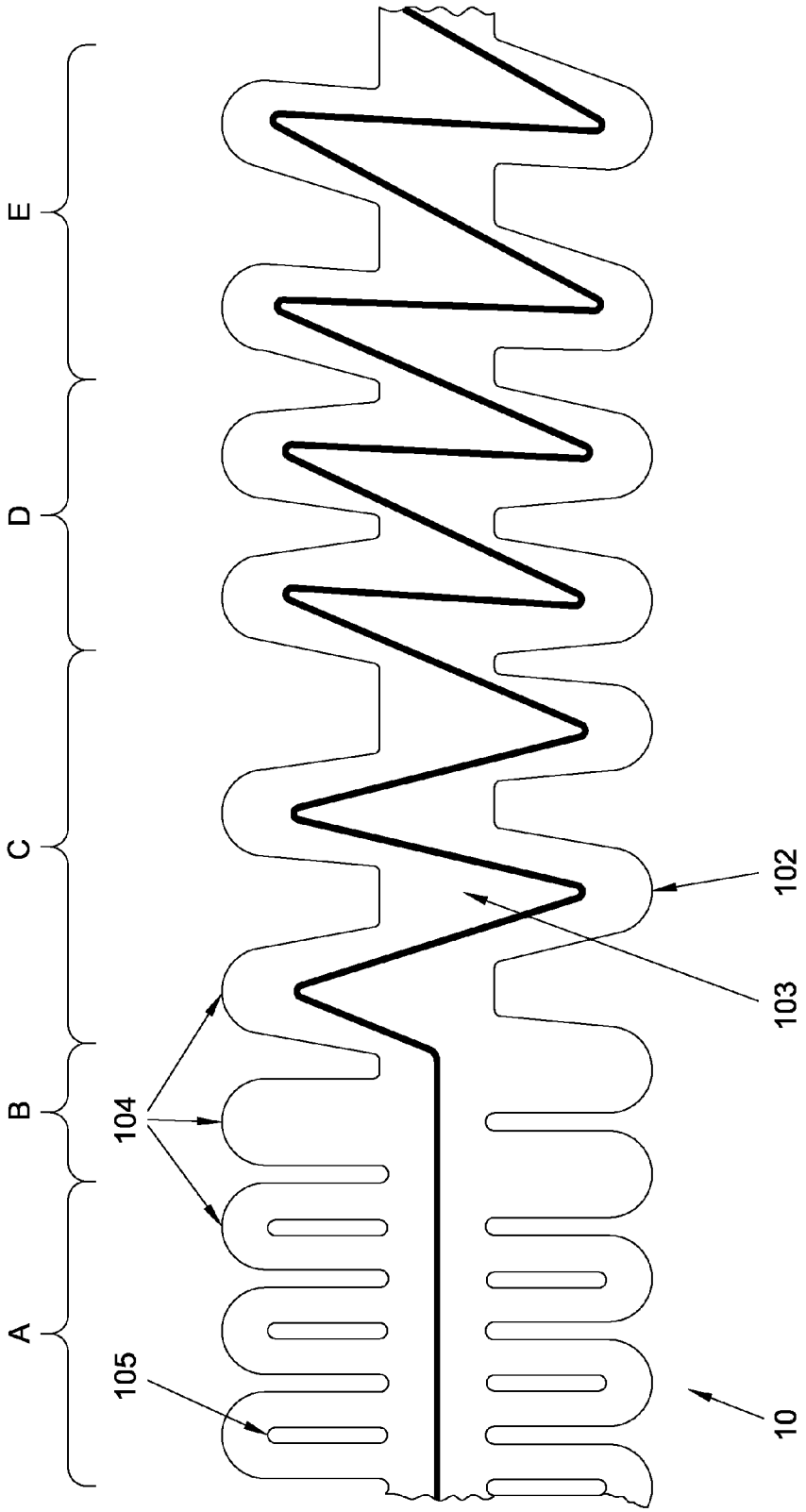

Fig. 2

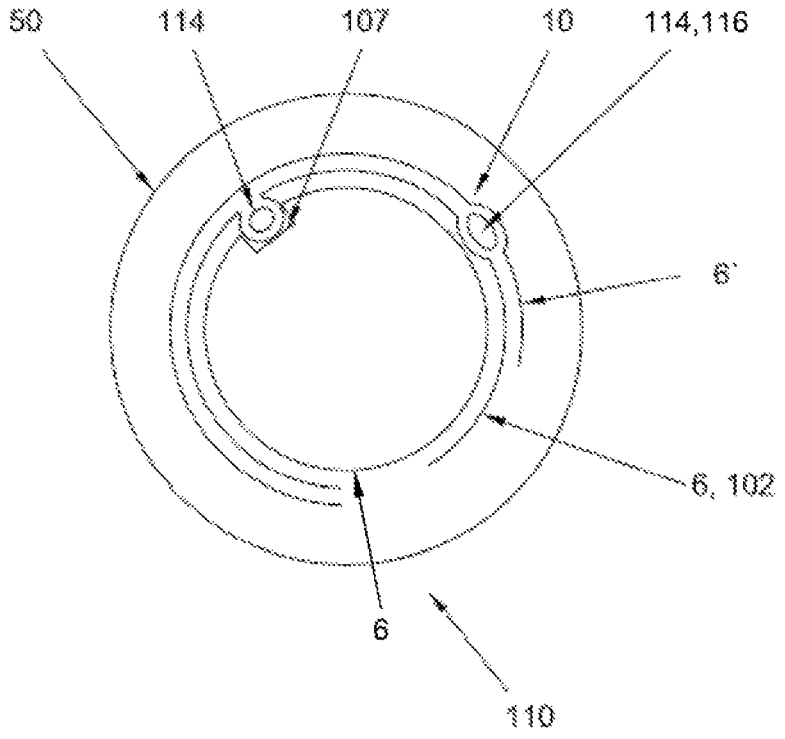

Fig. 3

HEATING DEVICE FOR COMPLEXLY FORMED SURFACES

CLAIM OF PRIORITY

The present application claims the benefit of the priority of the tiling dates of German Applications DE 10 2011 016 254.2, filed on Apr. 6, 2011; DE 10 2011 102 719.3, filed on May 20, 2011; DE 10 2011 121 147.4, filed on Dec. 15, 2011; DE 10 2011 122 134.8, filed on Dec. 23, 2011; and DE 10 2012 000 977.1, filed on Jan. 20, 2012, the contents of which are hereby incorporated by reference in their entirety.

BACKGROUND

Temperature controls, in particular electrical heating elements and heating conductors, are frequently subjected to high mechanical loads. At the same time, it must be possible to install them quickly and easily.

For that reason, technical solutions are required that can meet either one or several of these requirements appropriately.

SUBJECT

In view of this background, a technical concept with the features of: an electrical temperature control for controlling temperature of surfaces, wherein the electric temperature control has at least one heat distribution device which covers at least parts of a surface to be temperature controlled is proposed. Further advantageous embodiments can be found in the further Claims and the subsequent description. The present teachings further include a method for producing a temperature control comprising the following steps: a) providing a flat carrier and/or a heat distribution device; b) at least partially arranging an adhesive substance on the flat carrier and/or the heat distribution device; c) arranging at least one heater resistor element on the flat carrier and/or the heat distribution device; d) covering the flat carrier and/or the heater resistor element with a further carrier and/or a heat distribution device; e) punching an outer contour of the temperature control.

The invention simplifies particularly the installation of temperature control devices on devices with more complex surfaces.

The invention is suited particularly for use with any curved or contoured surfaces, in particular automobile seats, steering wheels, seat cushions, trim finishes in passenger compartments, armchairs or office equipment, for example, battery heating, aircraft wings, tanks, lines for liquids, gas, and other fluids (e.g. foods, chemicals).

FIGURES

The details of the invention are explained below. These explanations are intended to make it easier to understand the invention. They should only be regarded as examples, however, within the scope of the invention defined by the independent claims, it is obviously also possible to omit, change, or supplement individual or several of the features described. The features of different embodiments can obviously also be combined among one another. What is important is that the concept of the invention is essentially implemented. If one feature must be accomplished at least partially, then this includes moreover that this feature is accomplished completely or is essentially accomplished completely. In this context, "essentially" means in particular

that the implementation permits that the desirable benefit is accomplished to an identifiable extent. This can particularly signify that a respective feature is accomplished to the extent of at least 50%, 90%, 95%, or 99%. Where a minimum amount is stated, then obviously also more than this minimum amount can be used. If the quantity of a component is stated to be at least one, then this includes particularly also embodiments with two, three or any other plurality of components. Anything that is described for an object can also be used for the major part or the entirety of all other similar objects. Unless stated otherwise, all intervals also include their end points.

In the following, the Figures show:

FIG. **1** Is a partial cross-section of an automobile

FIG. **2** Is a horizontal projection onto an electrical flat temperature control with a heater resistor element and a heat distribution device

FIG. **3** Is a cross-section through a steering gear with a temperature control according to FIG. **2**.

DETAILED DESCRIPTION

FIG. **1** shows a vehicle **100**. This can involve, for example an aircraft, a railroad car, a ship, or like in this instance, an automobile.

The vehicle **100** has at least one item **110** to be temperature controlled. This particularly involves any components that can be contacted by a user in the passenger compartment, such as a steering gear for vehicles, a steering wheel, an instrument panel, an armrest, door trim, a seat cushion, a thermal blanket, the inside roof lining, padding, a cover, or a seat.

But this can also involve a battery, a fluid line, a mirror, a tank, a reservoir, or similar things.

The item to be temperature controlled **110** will preferably have at least one temperature control **10**. A temperature control is defined as any unit that can be specifically used to change the temperature in its environment, e.g. any devices with at least one electrical heater resistor, a heat pump, a Peltier element and/or air moving means, such as a blower.

FIG. **2** shows an embodiment of a temperature control **10**. Here, it is designed as a flat, flexible heating element. The temperature control **10** can be integrated as an insert in the padding of an interior trim item, such as a seat or a steering wheel.

The temperature control **10** and/or the item to be temperature controlled **110** has at least one carrier **102**. This should preferably be flat and be at least partially made of textile, fabric, knitted fabric, woven material, nonwoven fabric, flexible thermoplastics, air-permeable material and/or punched or napped sheeting. A textile is a flat entity made of filaments or fibers.

Preferably, at least one carrier **102** has a tape-like core section **103**. A plurality of blade sections **104** is arranged on the core section **103**. These are preferably formed as one piece with the core section. They can also be added subsequently, however. The blade sections **104** are preferably arranged in the same plane as the core section **103**, but they can also be arranged in a plane that runs parallel thereto, however. A stabilizing center ridge facilitates easy operation of the temperature control **10**. This moreover permits a heater resistor element **114** to be supported, even if same is curved.

The blade sections **104** can all be arranged on the same side of the core section **103**. This permits easier assembly, since all blade sections **104** can be removed in the same direction. The core section **103** is preferably provided with

blade sections **104** on both of its longitudinal edges, however. Preferably, several blade sections **104** are provided in at least one section A, B, C of the carrier **102** in an alternating configuration. This particularly means an asymmetric configuration with respect to the longitudinal axis of the core section **103**. A configuration of the tips of the blade sections **104** and/or the attachment points of the blade sections **104** which is alternately offset is particularly suitable, for example.

The core section **103** has at least one section D, E, in which at least one part of the blade sections **104** is configured opposite.

An opposite configuration means in particular that the blade sections **104** are arranged symmetrical at least in sections on the core section **103** of the carrier **102**. Particularly suitable is a reciprocal symmetrical configuration of attachment points or tips **104** of blade sections, for example. This permits adequate cover in a steering wheel web area, for example.

Preferably, at least one blade section **104** has a cutout **105**. This is preferably located in a central area of the blade section **104**. This permits the blade section **104** to be bent around a bend axis even if a core section **103** is bent around a further bend axis, without creasing.

Preferably the carrier **102** consists at least partially of a material which has pores, mesh openings, perforations, or similar things. This accomplishes low weight, good thermal transmittance, and at the same time high tensile strength of the carrier **102**. Perforated sheeting or reticulated textile fabrics are particularly suitable.

The carrier **102** is made preferably, at least in sections, of an electrically insulating material. This permits the use of non-insulated heater resistor elements and economical materials.

The temperature control **10** in particular has at least one heater resistor element **114** that is arranged at, on and/or in the carrier **102**. Preferably, a multicore heater resistor element **114** is provided in the form of a heating section where the cores are preferably arranged reciprocally twisted and electrically parallel. At least one heater resistor element **114** is attached on carrier **102** partially or across the entire surface with an adhesive, for example. The heater resistor element **114** has an electrical resistance of between 100 Ω/m and 1000 Ω/m, better 100 and 800 Ω/m, better 300 and 500 Ω/m. The heater resistor element is preferably formed at least pro rata from a material with PTC characteristics. This will preferably involve stranded wire. If the heater resistor element forms a conductor loop or phase winding with an outgoing lead and a return wire which are short-circuited on their one end, then the heater resistor element will require a contact only on a single position of the steering wheel.

The heater resistor element **114** is preferably arranged at least in sections along the central axis of the carrier **102**. This aims at using as little material as possible and to have minimum mechanical deformation.

The heater resistor element **114** is preferably arranged meandering. Preferably it also extends at least in sections into the blade sections **104**. Preferably it is arranged so that the distance to the edge of the carrier **102** is constant. It therefore follows the outside contour of the carrier **102** at least in sections. This is useful with an alternating configuration of the blade sections **104**, for example. Here, it is possible that the meandering course of the heater resistor element **114** is harmonically congruent with the alternating configuration of the blade sections **104**. The heater resistor element **114** can also be arranged at least in sections such that it does not follow the outside contour of the carrier **102**. This can be useful with an alternating configuration of the blade sections **104**, for example, so that all blade sections **104** are covered with one heating section.

It can be provided that at least two heater resistor elements **114** are arranged on the carrier **102**. This will achieve increased reliability, the supply of respectively one of the two edge sections of the temperature control element with one inherent heater resistor element **114** and a varying temperature control in different zones by means of individual adjustment of the heating capacity in a specific zone.

It can be provided that at least two heater resistor elements **114** are arranged reciprocally parallel along the core section **103** of the carrier **102**.

The temperature control **10** preferably has at least one flat heat distribution device **6**. For this purpose, particularly layers with metallic constituents, such as aluminum, foils or sheets are suitable. Preferably, one heat distribution device **6**, **6'** each is arranged on the upper and the underside of the heater resistor element **114**, such as in the form of a heat conducting layer, such as from aluminum foil, in the thickness between 0.01 and 0.5 mm, for example, preferably from 0.1 to 0.2 mm. The distribution devices **6** protrude beyond the heater resistor element **114** and are attached to each other in projecting areas with an adhesive or an adhesive tape, for example. This results in an especially good heat transfer from the heater resistor element to the heat distribution devices **6**.

Preferably at least one heat distribution device **6** has a tape-like core section **103'**. A plurality of blade sections **104'** is arranged on the core section **103'**. These are preferably formed as one piece with the core section **103'**. They can also be adjoined subsequently, however. The blade sections **104'** are preferably arranged in the same plane as the core section **103'**, but they can also be arranged in a plane that runs parallel thereto, however. This permits easy operation of the heating element by means of a stabilizing center ridge.

The blade sections **104'** can all be arranged on the same side of the core section **103'**. The core section **103'** is preferably provided with blade sections **104'** on both of its longitudinal edges, however. This permits improved heat distribution because of the smaller distance between the heater resistor element **114** and a tip of a blade section **104'**.

In other respects, the previous comments made with respect to the carrier are applicable analogously for the structure of the heat distribution device **6**, **6'**.

The heat distribution device **6** is preferably made at least partially of a material which has good thermal conductance. Perforated sheeting or reticulated textile fabrics are particularly suitable:

Preferably at least one heat distribution device **6** is connected to ground, in order to shield against electromagnetic fields and provide users additional protection in the event of electrical circuit faults.

Preferably at least one heat distribution device **6** is arranged identical with the carrier **102** or congruent with it. All heat distribution devices **6** are preferably arranged reciprocally congruent. Advantageously, at least one textile carrier and at least one metallic heat distribution device with at least one embedded heating conductor in between form a sandwich, wherein the textile carrier is arranged closer to the surface to be temperature controlled than the heat distribution device, in order to achieve a cushioning effect. But it can also be provided, that the textile carrier points to the steering wheel core and the heat distribution device points to the surface of the steering wheel, to accomplish improved heat transfer to the steering wheel surface. To ensure high

haptic comfort it is also possible to arrange a heat distribution device between two textile layers or two carriers **102**.

It can be provided that one heat distribution device **6'** has at least one blade section **104'** where its distance from the central axis of the blade section **104'** is shorter than that of at least one second heat distribution device **6** which is arranged congruent with respect to its longitudinal axis. This permits material savings while at the same time having sufficient thermal exchange with areas at a distance from the heater resistor elements **114**.

For logical reasons, the temperature control **10** has a temperature sensor which interrupts the current supply to at least part of the heater resistor elements **114** when the temperature exceeds 60° C., for example. The temperature sensor can be a thermostat, for example. In addition or as an alternative to the heater resistor element **114**, one or several Peltier elements can be provided which assist in cooling the heat distribution device **6**.

The temperature control **10** preferably has at least one heat distribution device **6**, which encloses at least sections of heater resistor element **114** and at least in sections and does so at least partially. When looking at a cross-section, preferably at least 50% of the circumference of the heater resistor element **114** of the heat distribution device **6** is enclosed, preferably particularly 70%, preferably 90%.

A heater resistor element **114** is arranged preferably between at least two heat distribution devices **6**, **6'**. Because of the large contact area, this results in a high heat transfer between the heater resistor element **114** and the heat distribution devices **6**, **6'**. Preferably at least one insulation is arranged between the heater resistor element **114** and at least one heat distribution device **6**. This can be provided as an insulation coating on the heater resistor element **114**, for example. Also at least one heat distribution device **6**, **6'** can be coated with an insulation layer. Preferably, at least two heat distribution devices **6**, **6'** are connected to each other with at least one bonding material that is arranged in between them. Double-sided adhesive tapes or spray adhesives are particularly suitable.

It can also be provided that at least two heat distribution devices **6**, **6'** are connected to each other non-positively and/or positively, at least in sections. This can have been done by means of embossing of knops and cutouts or by reciprocal compression. In such areas it can be advantageous if no adhesive is used, especially when high temperatures are present there.

The temperature control **10** is preferably produced using the following steps:

a) Provision of a flat carrier **102** and/or a heat distribution device **6**.

b) At least the partial arrangement of an adhesive substance on the carrier **102**/ of the heat distribution device **6**.

c) Arranging at least one heater resistor element **114** on the carrier **102**.

d) Covering the heater resistor element **114** with a further carrier **102** and/or a heat distribution device **6**.

e) Punching of the outer contour of the temperature control **10**.

But it is also possible to interchange the production steps and to install the heater resistor elements **114** on the carrier **102**, for example, the outer contour of which has already been trimmed.

The temperature control **10** can now be arranged so that the surface to be heated is brought up to temperature as uniformly as possible. For this purpose it can be advantageous that the surface be contoured such that a heater resistor element **114**, a heat distribution device, a flat carrier or other components with a greater thickness can be flush-mounted into corresponding recesses **107** to achieve a uniform surface contour of a cover **50**, for example. Preferably the depth and width of such recesses **107** are sized a little bit larger than the respective thickness and width dimensions of the components to be flush-mounted.

During heating or cooling, it is not necessary for the entire surface to be temperature controlled and to be covered with a heater resistor element **114** or cooling element. It is rather feasible to do the respective heating/cooling at suitable positions and to apply the heat fed into or taken out of the heat distribution device **6** uniformly onto the surface to be temperature controlled via the heat distribution device **6**.

LIST OF REFERENCE SYMBOLS

6, **6'** Heat distribution device
10 Temperature control
50 Cover
100 Vehicle
102 Carrier
103, **103'** Core section
104, **104'** Blade section
105 Cutout
107 Recess
110 Item to be temperature controlled
114 Heater resistor element
116 Cooling element

The invention claimed is:

1. An electric temperature control device for controlling a temperature of a surface, the temperature control device comprising:

at least one heat distribution device covering at least part of the surface to be temperature controlled, the at least one heat distribution device having metal layers,

at lease one carrier comprising:

i. an elongated tape-like core section extending along a longitudinal axis,

ii. a plurality of blade sections, each of the blade sections are projections that project and extend from opposing longitudinal edges of the core section, and

iii. at least one heater resistor element,

wherein the at least one heater resistor element is arranged between two flexible metal layers of the heat distribution device that project at least partially beyond sides of the at least one heater resistor element to cover a larger area than a base area of the at least one heater resistor element,

wherein in a first portion of the core section, the at least one heater resistor element extends generally along the longitudinal axis and is free from extending into the blade sections, and in a second portion of the core section, the at least one heater resistor element extends into the blade sections, and

wherein the at least one heater resistor element is a standard wire that forms a conductor loop, phase winding, or both with an outgoing lead and a return wire.

2. The electric temperature control device according to claim **1**, wherein at least one blade section of the plurality of blade sections has a cutout.

3. The electric temperature control device according to claim **2**, wherein the at least one carrier is comprised at least partially of a material which has pores, mesh openings, perforations, the like, or a combination thereof.

4. The electric temperature control device according to claim 3, wherein the at least one heat distribution device is arranged between two textile layers or two carriers.

5. The electric temperature control device according to claim 4, wherein the electric temperature control is integrated as a: insert into padding of a seat or a steering wheel.

6. The electric temperature control device according to claim 1, wherein the electric temperature control device has at least one electrical cooling element.

7. The electric temperature control device according to claim 1, wherein the electric temperature control device includes a heat pump, a Peltier element, an air moving means, or a combination thereof.

8. The electric temperature control device according to claim 1, wherein the at least one carrier is comprised at least partially of a material which has pores, mesh openings, perforations, the like, or a combination thereof.

9. The electric temperature control device according to claim 1, wherein the at least one heat distribution device is arranged between two textile layers or two carriers.

10. The electric temperature control device according to claim 1, wherein the electric temperature control device is integrated as art insert into padding of a seat.

11. The electric temperature control device according to claim 1, wherein the plurality of blade sections are arranged in asymmetrical sections relative to a longitudinal axis of the at least one carrier.

12. The electric temperature control device according to claim 1, wherein the plurality of blade sections are arranged in sections relative to the longitudinal axis of the at least one carrier,

wherein at least some of the sections are symmetrically arranged relative to the longitudinal axis and at least some of the sections are asymmetrically arranged relative to the longitudinal axis.

13. The electric temperature control device according to claim 1, wherein the at least one heater resistor element has an electrical resistance between 100 Ω/m and 1000 Ω/m.

14. An electrical temperature control device for controlling a temperature of a surface comprising:

a carrier core extending along a longitudinal carrier axis, the carrier core having a plurality of carrier blade sections, each of the carrier blade sections are projections that project and laterally extend from opposing edges of the carrier core relative to the carrier axis, the carrier blade sections are arranged in carrier sections on the opposing edges of the carrier core that are asymmetric, symmetric, or a combination of both about the carrier axis,

at least one heater resistor element arranged on the carrier core, and

a heat distribution device arranged on an upper side of the at least one heater resistor element, an underside of the at least one heater resistor element, or both, the heat distribution device protrudes beyond the at least one heater resistor element, the heat distribution device includes a distribution core extending along a distribution axis with distribution blade sections that are projections laterally extending from opposing edges of the distribution core relative to the distribution axis, the distribution blade sections are arranged in distribution sections on opposing edges of the distribution device that are asymmetric, symmetric, or a combination of both about the distribution axis,

wherein at least some of the carrier blade sections have a cutout, and at least some of the carrier blade sections are free of a cutout,

wherein in at least one area of the carrier core, the at least one heater resistor element extends into one or more of the carrier blade sections that are free of a cutout and the at least one heater resistor element is generally free from extending along the carrier axis,

wherein in at least one other area of the carrier core, the at least one heater resistor element is arranged generally along the carrier axis and the at least one heater resistor element does not extend into one or more of the carrier blade sections that have the cutout, and

wherein the at least one heater resistor element is a standard wire that forms a conductor loop, phase winding, or both with an outgoing lead and a return wire which are short-circuited on their one end.

15. The electrical temperature control device of claim 14, wherein the electrical temperature control device has at least one electrical cooling element assisting in cooling the heat distribution device.

16. The electrical temperature control device of claim 14, wherein the carrier core and the heat distribution device include at least one heater resistor element therebetween forming a sandwich.

17. The electrical temperature control device of claim 14, wherein the carrier core and the heat distribution device include at least one heater resistor element therebetween forming a sandwich,

wherein the heat distribution device is arranged closer to the surface to be temperature controlled than the carrier core.

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